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Lovegrove et al.

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(54) **APPARATUS FOR TESTING ELECTRICAL ACTIVITY FROM A BIOLOGICAL TISSUE SAMPLE**

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B01L 9/00 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G01N 33/4833*** (2013.01)

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USPC 435/287.1; 422/561, 560; 165/185
See application file for complete search history.

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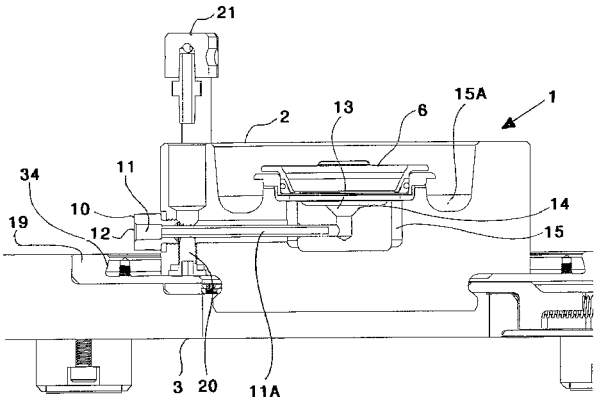
(57) **ABSTRACT**

An apparatus (**100**) for testing electrical activity from a biological tissue sample comprises a body (**1**) provided with a well (**4**), stimulating means (**8**) for stimulating a sample located in the well (**4**), and detecting means (**9**) for detecting electrical activity in the sample. In one embodiment the apparatus has a fluid inlet means (**10**) and a fluid outlet means (**16**) in fluid communication with the well (**4**). The inlet means (**10**) comprises an electrically conductive conduit (**11**A) which is in fluid contact with a fluid flowing, in use, though the outlet means (**16**). In some embodiments the apparatus is provided with an electrically conductive member (**19**) which is in electrical contact with a fluid contained, in use, in at least one of the well (**4**), inlet means (**10**) and outlet means (**16**). The stimulating means (**8**) and detecting means (**9**) are engaged with the body (**1**) by a gripping means (**32**) which comprises an electrically conductive gripping member (**36**). Related methods and apparatus are also disclosed.

10 Claims, 9 Drawing Sheets



(51) **Int. Cl.**
F28F 7/00 (2006.01)
G01N 33/483 (2006.01)

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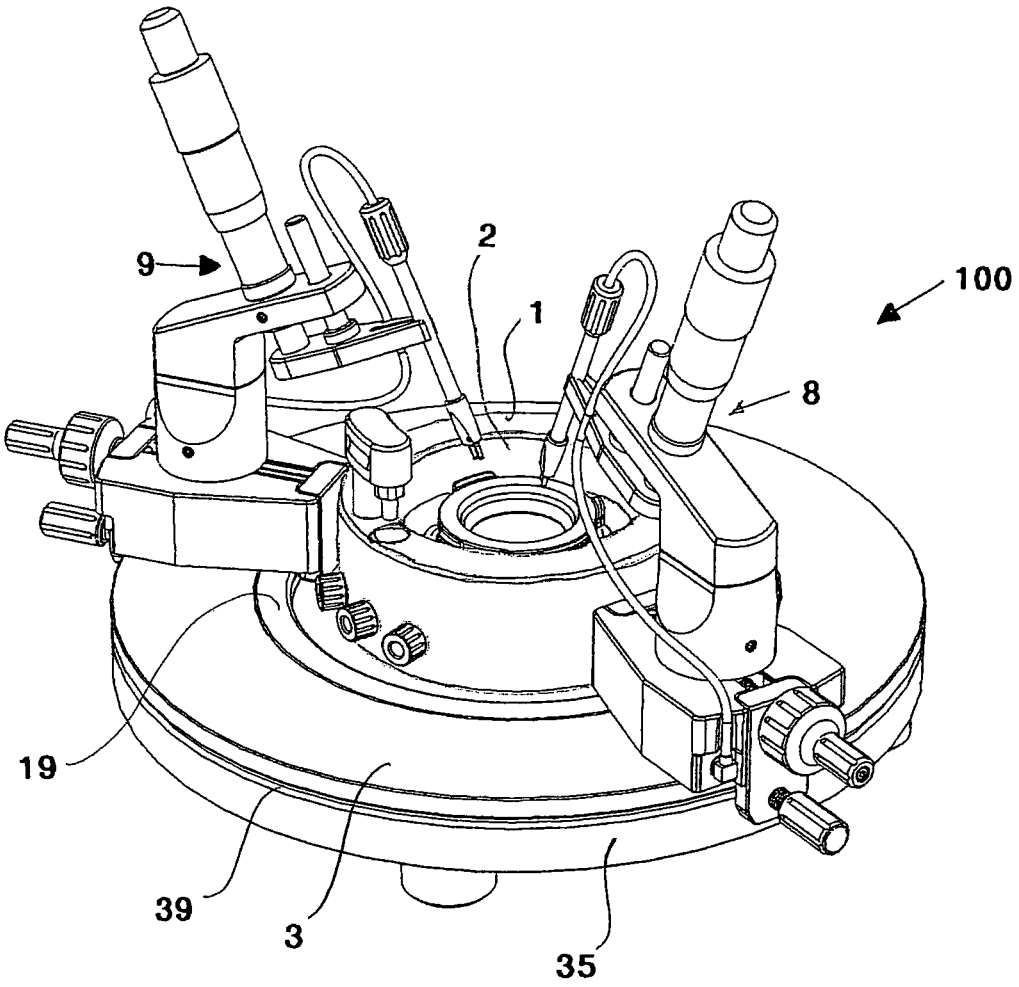

FIGURE 1

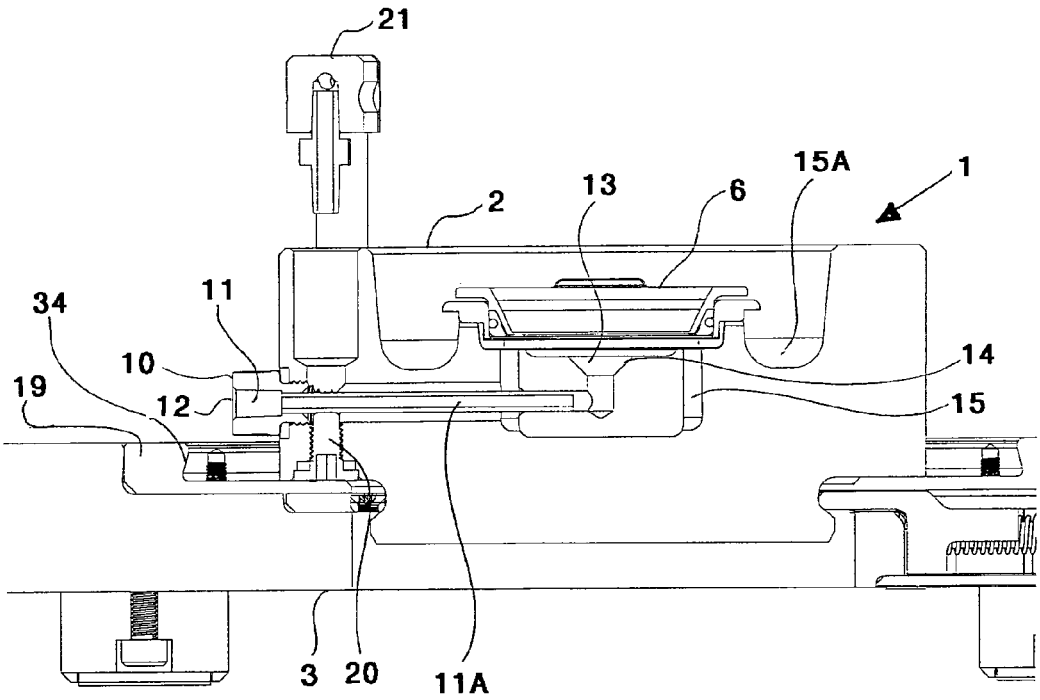

FIGURE 2

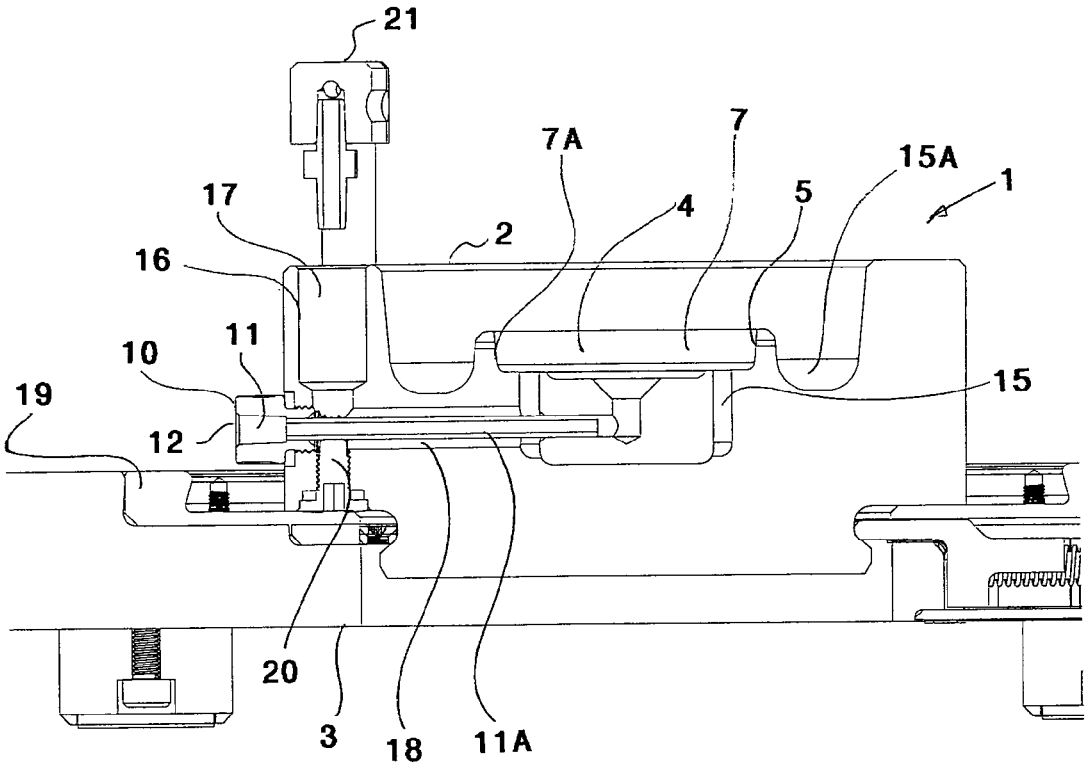

FIGURE 2A

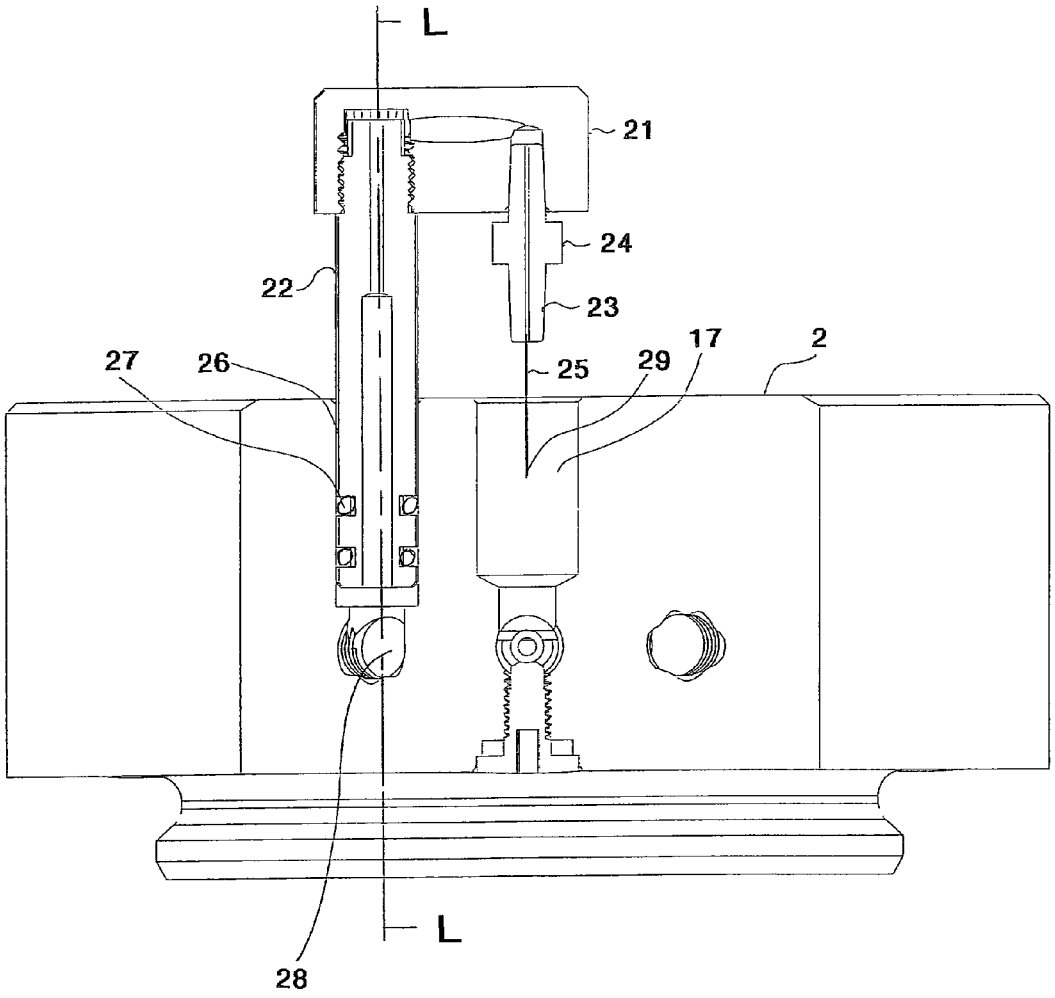

FIGURE 3

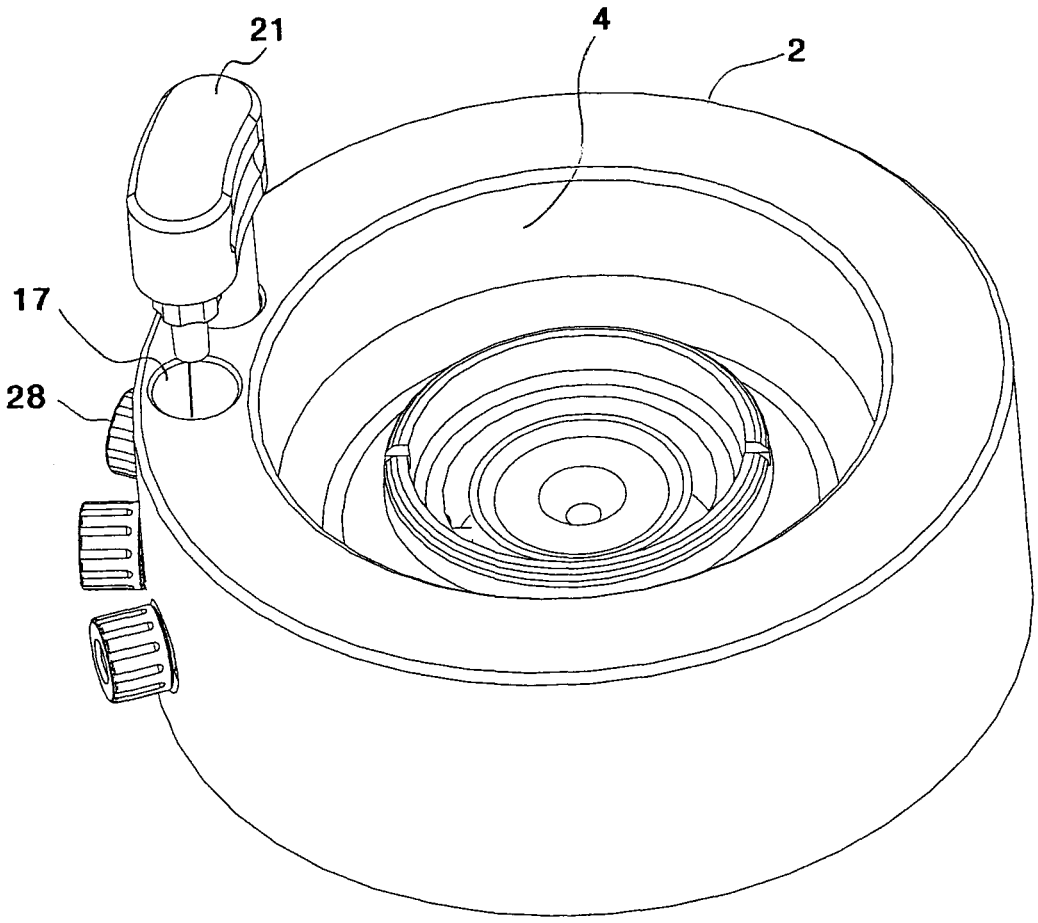

FIGURE 4

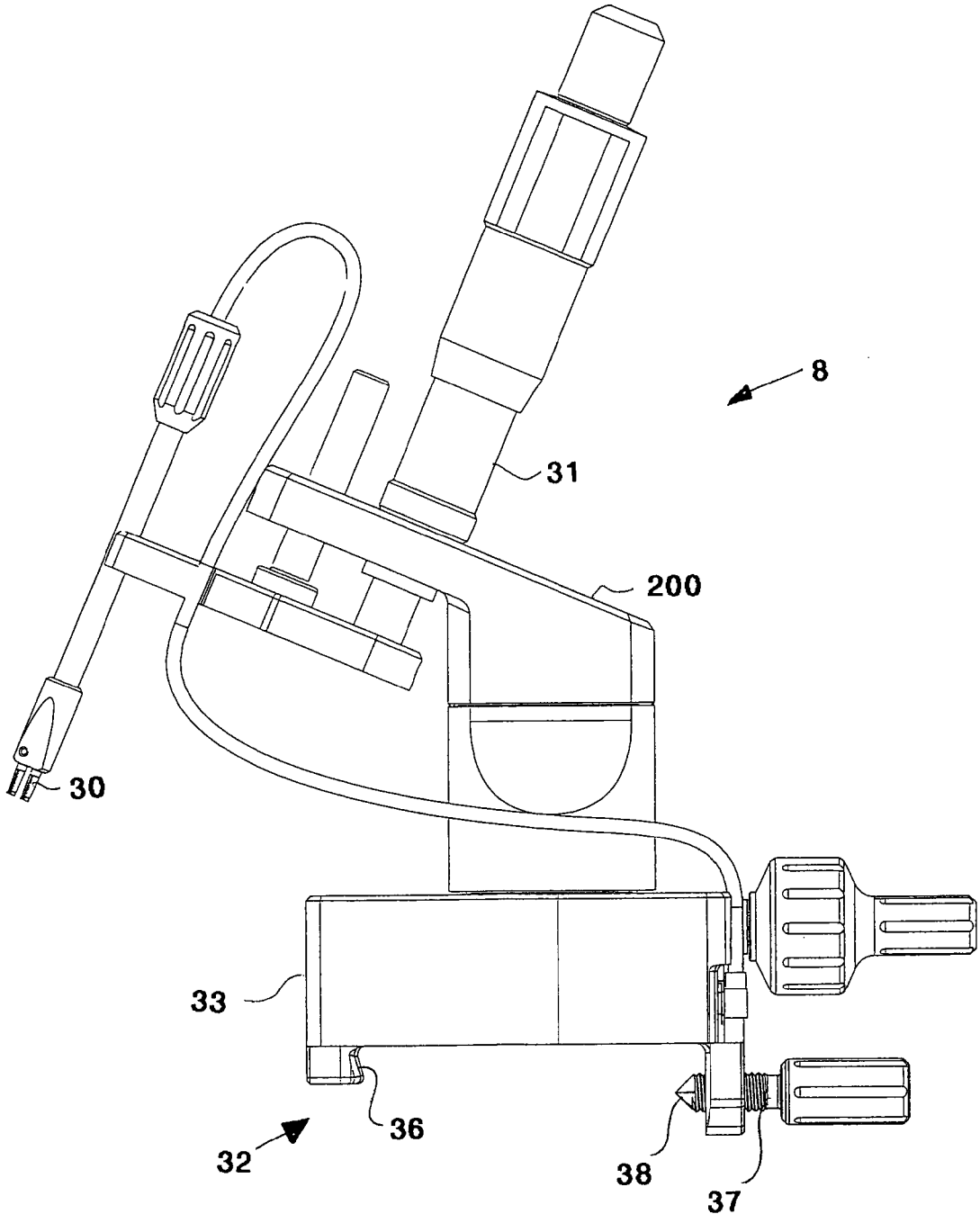

FIGURE 5

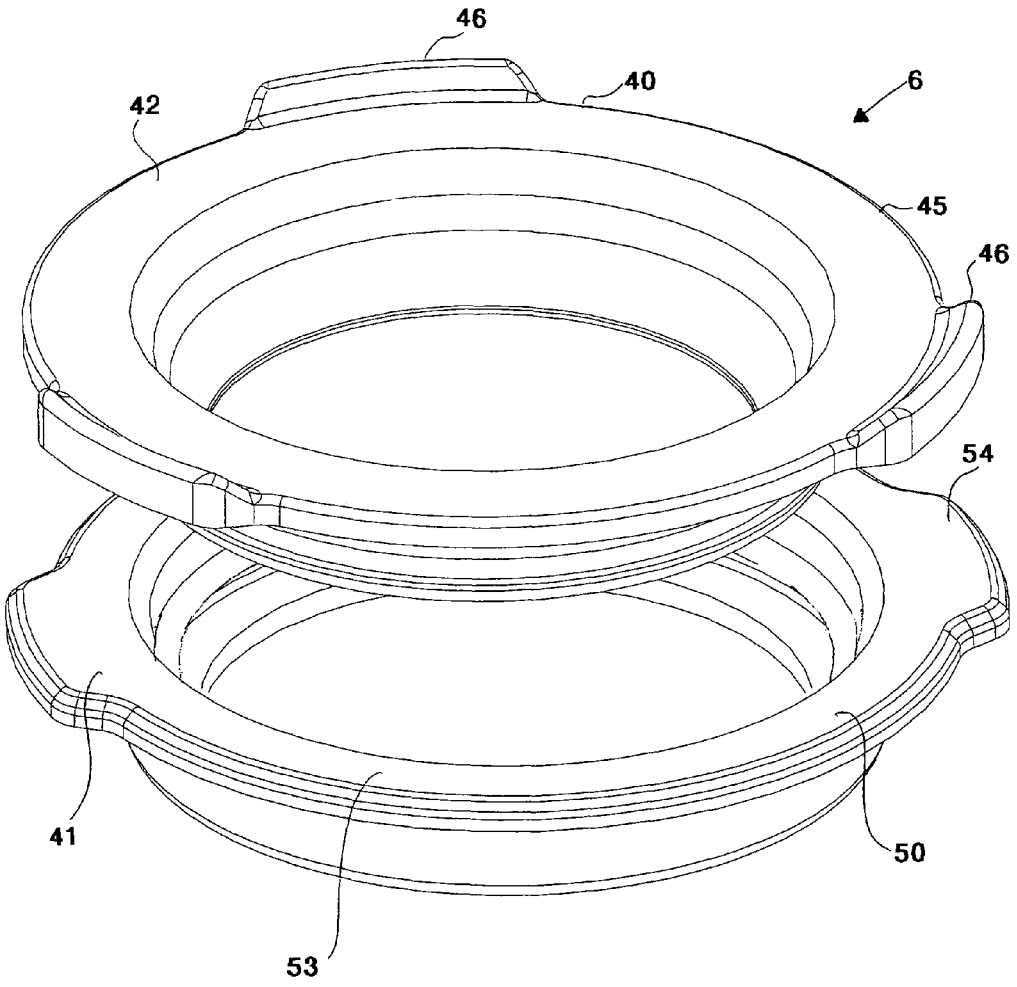

FIGURE 6

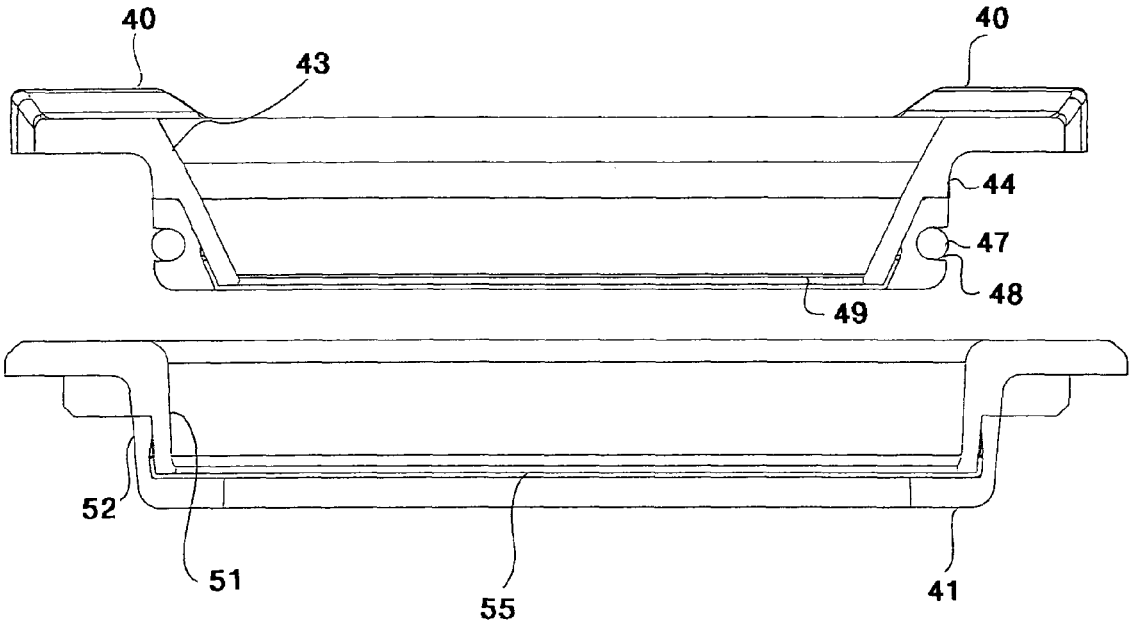

FIGURE 7

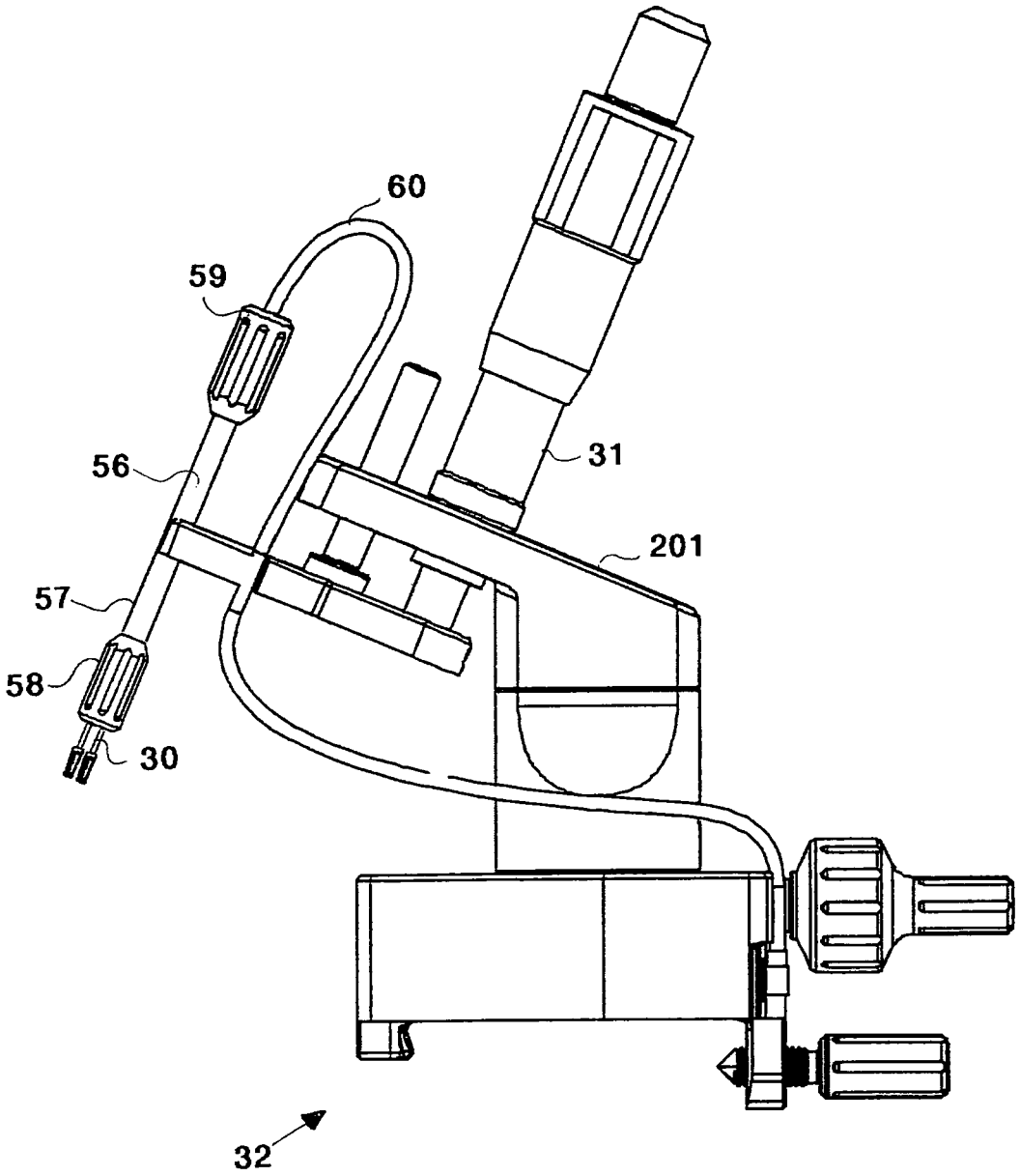

FIGURE 8

APPARATUS FOR TESTING ELECTRICAL ACTIVITY FROM A BIOLOGICAL TISSUE SAMPLE

RELATED APPLICATIONS

This application is a 35 U.S.C. §371 national stage filing of PCT Application No. PCT/NZ2009/000250, filed on Nov. 12, 2009, which claims priority to U.S. Provisional Patent Application No. 61/114,042, filed on Nov. 12, 2008. The entire contents of the aforementioned applications are hereby incorporated by reference.

The present invention relates to equipment for testing electrical activity from biological tissue, and in particular, but not exclusively, to a portable system which is easily disassembled.

BACKGROUND TO THE INVENTION

The present invention relates to laboratory equipment, commonly referred to as "tissue recording chambers" or "brain slice chambers" which allow the user to record and assess the effects of drugs and toxins on living, electrically excitable tissues.

Apparatus of this type are often used to analyse the effects of drugs and/or neurotoxins on brain tissue from rats. However, recording techniques have been recently adapted to include cardiac tissue. Other excitable tissues of potential interest are skeletal muscle and retina.

In an example of a tissue recording system of the prior art, fluids are directed into a chamber through a small diameter stainless steel tube which projects into a tissue recording chamber, also known as a slice bath. The fluids contain oxygen, salts and essential nutrients for the tissue, as well the toxins or drugs which are the object of the study.

The subject tissue slice is held in position between two nets. Fluids superfuse the tissue and then flow into a reservoir or moat or which directs the fluids out again through a separate channel and into a suction port. The fluids are drawn out of the suction port by a disposable small gauge needle fitted to an adjustable post which allows the user to regulate the level of the fluid in the suction port, and therefore in the recording chamber. The fluids are finally drawn away from the tissue recording system via a length of flexible tubing which extends between the needle and a vacuum source.

An electrical stimulus is applied to the tissue slice via an electrode connected to a micromanipulator. The signal produced by the tissue sample is recorded by a second electrode held in a second micromanipulator. An amplifier is provided in the base of the micromanipulator to amplify the signal before it is recorded by a data recording system.

The prior art apparatus described above has a number of inherent disadvantages.

Electrical grounding and communication of the recording chamber 'bath potential' to the amplifier is achieved by a small spring loaded pin which is pressed into the underside of the recording chamber to make contact with a stainless steel fluid input tube. The pin also makes contact with the upper surface of an annular grounding ring pressed into the recording chamber platform. The upper surface of the grounding ring is also in contact with a spring loaded pin which is in direct contact with an amplifier housed in the base of the micromanipulator.

This system of grounding works reasonably well in terms of grounding noise entering the system via the input tube, but may fail to adequately ground noise entering the system through the vacuum line and suction port. In addition, the spring loaded pins may be physically weak and prone to failure following several years of use.

Recording and stimulating electrodes are positioned over the tissue slice using modular attachable micromanipulators which are designed to hold adjustable tubular steel electrode guides. The guides hold fixed electrodes. The electrode pin sockets are permanently affixed in plastic end caps and the user then manually connects the electrodes for use on a daily basis.

The tubular steel probe guides are gripped in the 'arms' of the micromanipulators and can be slid up or down as needed to allow the micromanipulator arm to be swung aside for placement of fresh slices in the bath. However, the extremely delicate electrodes themselves are in danger of damage, and the probe guides can not be removed for storage without first removing the individual electrodes.

The tissue sample is held in position in the bath between two net rings. The two rings fit together, one within the other, and are referred to as the top net and the bottom net. Together they serve to sandwich and stabilize tissue slices for vibration-free recording.

The nets are relative fragile. If the nets are torn during use, which is reasonably common, then the user has to sand away and manually replace the netting material. With repeated use the net rings tended to lose their original fit, becoming too tight, and requiring sanding or honing, or too loose, requiring the fabrication of spacers or shims to prevent slippage. Because they often fit very snugly in the bath and to one another, and because they are small and difficult to grip, a special tool is required to remove the net rings.

OBJECT OF THE INVENTION

It is an object of the invention to provide an apparatus for testing electrical activity from a biological tissue sample which will overcome or ameliorate problems with such apparatus at present, or at least one which will provide the public with a useful choice.

It is an alternative object of the invention to provide a mounting means for an electrode which will overcome or ameliorate problems with such apparatus at present, or at least one which will provide the public with a useful choice.

It is a further alternative object of the invention to provide a net assembly adapted to hold a biological tissue sample in position in an apparatus for testing electrical activity from sample, or at least one which will provide the public with a useful choice.

Other objects of the present invention may become apparent from the following description, which is given by way of example only.

SUMMARY OF THE INVENTION

According to one aspect of the present invention there is provided an apparatus for testing electrical activity from a biological tissue sample, the apparatus comprising a body provided with a well, the apparatus further comprising stimulating means for stimulating a biological tissue sample which is located, in use, in the well, and detecting means for detecting electrical activity in the tissue sample, the body provided with a fluid inlet means in fluid communication with the well and outlet means comprising an upwardly open outlet port in fluid communication with the well, and adjustable fluid level regulation means adapted to draw fluid, in use, from the upwardly open outlet port at a required level, the outlet means comprising an outlet aperture which is substantially fixed in position relative to the body.

Preferably the outlet aperture is provided in the body of the apparatus.

Preferably the fluid level regulation means comprises an elongate member with a suction inlet means provided at or adjacent a first end, and a second, distal end of the elongate member adapted to sealingly and slidingly engage a mounting aperture in the body, wherein the level of the suction inlet means relative to the upwardly open port can be adjusted by sliding the elongate member up or down in the mounting aperture.

Preferably the fluid regulation means is provided with a conduit between the inlet means and the distal end of elongate member.

Preferably the mounting aperture is in fluid communication with the outlet aperture.

Preferably the suction inlet means comprises means for mounting a disposable needle.

According to a second aspect of the present invention there is provided an apparatus for testing electrical activity from a biological tissue sample, the apparatus comprising a body provided with a well, the apparatus further comprising stimulating means for stimulating a biological tissue sample which is located, in use, in the well, and detecting means for detecting electrical activity in the tissue sample, the apparatus further comprising a fluid inlet means in fluid communication with the well and a fluid outlet means in fluid communication with the well, wherein the inlet means comprises an electrically conductive conduit which is in fluid contact with a fluid flowing, in use, though the outlet means.

Preferably the outlet means comprises an outlet passage provided in the body, and the electrically conductive conduit means extends into the outlet passage.

Preferably the electrically conductive conduit has an electrical resistivity of less than 1×10^{-6} Ωm at room temperature.

Preferably the electrically conductive conduit has a thermal conductivity of at least 10 W/m K at room temperature.

Preferably the outlet means comprises a passage adapted to receive a heating element such that the heating element is in thermal contact with fluid flowing though the outlet conduit upstream of the electrically conductive conduit, to thereby transfer heat to the fluid in the inlet means through the electrically conductive conduit.

According to a third aspect of the present invention there is provided a method of heating a fluid entering an apparatus for testing electrical activity from a biological tissue sample, the apparatus comprising a fluid inlet means comprising a thermally conductive inlet conduit and a fluid outlet means which has a portion in fluid contact with the thermally conductive inlet conduit, the method comprising heating a fluid flowing through the outlet means upstream of the thermally conductive inlet conduit and transferring heat from the fluid in the outlet means to the fluid in the inlet conduit though the thermally conductive inlet conduit.

According to a fourth aspect of the present invention there is provided an apparatus for testing electrical activity from a biological tissue sample, the apparatus comprising a body provided with a well, stimulating means for stimulating a biological tissue sample located, in use, in the well, and detecting means for detecting electrical activity in the tissue sample, a fluid inlet means in fluid communication with the well and a fluid outlet means in fluid communication with the well, the apparatus further comprising an electrically conductive member in electrical contact with a fluid contained, in use, in at least one of the well, inlet means and outlet means, wherein at least one of the stimulating means and detecting means is engaged with the body by a gripping means which comprises an electrically conductive gripping member which engages the electrically conductive member, and the electrically conductive gripping member is electrically connectable to a data recording system which, in use, records the electrical activity from the sample.

Preferably the electrically conductive member is in electrical contact with a fluid contained, in use, in both the inlet means and the outlet means.

Preferably, the electrically conductive member comprises an annular ring.

Preferably the annular ring is set into the body.

Preferably, the electrically conductive gripping member exerts a force on an inner surface of the annular ring in a radially outward direction.

According to a fifth aspect of the present invention there is provided a mounting means for an electrode, the mounting means comprising a base and an electrode engaging means connected to the base, the electrode engaging means comprising a sheath provided with releasable electrode gripping means at a first end for releasably gripping the electrode, wherein the sheath is shaped and dimensioned to allow the electrode to be retracted within the sheath to a stored position.

Preferably the sheath is a hollow tube.

Preferably the releasable gripping means comprises a chuck.

Preferably the chuck is a collet chuck.

Preferably the collet chuck is integral with the sheath.

Preferably the sheath is provided with releasable wire gripping means at the distal end to the releasable electrode gripping means.

According to a sixth aspect of the present invention there is provided a net assembly adapted to hold a biological tissue sample in position in an apparatus for testing electrical activity from sample, the net assembly comprising a first net means having a first substantially annular frame and a netting material extending across one end of the first cylindrical frame, the first net means nestably engageable with a second net means having a second substantially annular frame and a netting material extending across one end of the second annular frame, wherein the first net means comprises a plurality of tab formations extending radially outward from a distal end of the first frame to the netting material.

Preferably an inner surface of the first annular frame is substantially frusto-conical.

Preferably, the first net means comprises a plurality of tab formations substantially evenly spaced around the first frame.

Preferably the second net means comprises at least one tab formation extending radially outward from the second frame at a distal end to the netting material.

Preferably the second net means comprises a plurality of tab formations substantially evenly spaced around the second frame, wherein the second net means is provided with a different number of tab formations to the first net means.

According to a further aspect of the present invention there is provided an apparatus for testing electrical activity from a biological tissue sample substantially as herein described with reference to the accompanying drawings.

According to a still further aspect of the present invention there is provided a net assembly substantially as herein described with reference to FIGS. **6** and **7**.

The invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, in any or all combinations of two or more of said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which the invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

Further aspects of the invention, which should be considered in all its novel aspects, will become apparent from the following description given by way of example of possible embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**: Is a perspective view of the apparatus of the present invention.

FIG. **2**: Is an enlarged cross-section side view through the centre of the apparatus of FIG. **1**, with the stimulating and detecting means removed for clarity.

FIG. **2**A: Is the cross-section of FIG. **2**, with the net assembly removed for clarity.

FIG. **3**: Shows a front view of the well assembly of the apparatus of FIG. **1** in partial cross-section through the adjustable fluid level regulating means, and with a needle engaged with the fluid level regulation means.

FIG. **4**: Shows a perspective view of the well assembly and fluid level regulating means of the apparatus of FIG. **1**, with a needle engaged with the fluid level regulation means.

FIG. **5**: Shows a side view of the stimulating means of the apparatus of FIG. **1**.

FIG. **6**: Shows an exploded perspective view of a net assembly of the apparatus of FIG. **1**.

FIG. **7**: Shows an exploded cross-section of the net assembly of FIG. **6**.

FIG. **8**: Shows a side view of the stimulating means with an alternative electrode mounting means.

BEST MODES FOR PERFORMING THE INVENTION

Referring first to FIGS. **1**, **2** and **2**A, the apparatus **100** of the present invention comprises a body **1** having a chamber assembly **2** which is connected to or integral with a base **3**. The base **3** is preferably substantially disc shaped. A well **4** is formed within the chamber assembly **2**, as is best seen in FIG. **2**A.

The well **4** comprises a cradle formation **5** for holding a net assembly **6** within which the tissue sample (not shown) is held. The cradle formation **5** is preferably provided with a substantially cylindrical recess **7**. The inner walls **7**A of the recess **7** preferably taper slightly inwardly.

Stimulating means **8**, for stimulating the tissue sample, and detecting means **9**, for detecting electrical activity in the tissue sample, are mounted to the body **1**.

A fluid inlet means **10** is provided though the body **1** to allow a perfusion fluid to flow into the well **4**. The inlet means **10** comprises a conduit **11** provided with an inlet aperture **12** outside the well **4** and an outlet **13** beneath the cradle. The outlet **13** is formed into a diffuser portion **14** which expands outwardly in the direction of the fluid flow. The diffuser portion **14** terminates directly below the cradle **5** and directs the fluid evenly through the net assembly **6** and over the tissue sample.

The inlet conduit **11** comprises a portion formed from an electrically conductive material such as a stainless steel tube **11**A. The tube **11**A is preferably both electrically conductive and thermally conductive, as is described further below. The electrically conductive material preferably has an electrical resistivity of less than 1×10^{-6} Ωm and a thermal conductivity of at least 10 W/mK.

In use, the perfusion fluid flows from a source (not shown) through the inlet conduit **11**. The fluid flows from the outlet **13** of the inlet conduit, through the net assembly **6** and over the tissue sample, and into an inner moat portion **15** of the well **4**.

An outlet means **16** comprises an upwardly open port **17** provided in the body **1**. The port **17** is in fluid communication with the well **4**, for example by means of an outlet passage **18** provided in the body **1** between the upwardly open port **17** and the well **4**. In a preferred embodiment the stainless steel tube **11**A extends through a portion of the outlet passage **18**, so that the stainless steel tube **11**A is fluid contact with the fluid flowing though the outlet passage **18**.

Because the tube **11**A is electrically conductive, it conducts any electrical charge from both the fluid stream flowing into the apparatus **100** through the inlet means **10**, and the fluid stream flowing out of the apparatus though the outlet means **16**.

The tube **11**A is in electrical contact with a common earth means. In a preferred embodiment the common earth means is an electrically conductive annular member **19** which is electrically connected to the steel tube **11**A by means of a grounding screw **20**. The grounding screw **20** preferably extends into the outlet passage **18** so as to be in contact with the fluid in both the outlet passage **18** and the inlet conduit **11**A.

Referring next to FIGS. **2** to **4**, and in particular FIG. **3**, an adjustable fluid level regulation means **21** is provided to regulate the level of the fluid in the well **4**. The fluid regulation means **21** comprises an elongate member **22** connected to a suction inlet means **23**. In a preferred embodiment the suction inlet means **23** comprises a fitting **24** adapted to releasably engage a disposable tube, for example a needle **25**.

The fluid regulation means **21** may be adapted to hold the disposable needle **25** substantially parallel with longitudinal axis L-L of the elongate member **22**.

The elongate member **22** is mounted to a mounting aperture **26** in the body **1** of the apparatus.

In a preferred embodiment both the elongate member **22** and the mounting aperture **26** are substantially circular in transverse cross section. The elongate member **22** is preferably provided with O-ring seals **27** to seal against the mounting aperture **26**.

The mounting aperture **26** is in fluid communication with an outlet aperture **28** provided in the body **1**.

In use, a needle **25** is mounted to the fitting **24**. The vertical position of the fluid regulation means **21** relative to the body **1** is adjusted by sliding the elongate member **22** up or down in the mounting aperture **26** as required. The position is adjusted until the tip **29** of the needle **25** is at the level required of the fluid in the well **4**.

The fluid level regulation means **21** is preferably held in position by the friction between the O-ring seals **27** and the mounting aperture **26**, but suitable locking means (not shown) may additionally or alternatively be used.

When a vacuum is applied to the outlet aperture **28**, fluid is drawn out of the upwardly open port **17** by the needle **25**. The rate at which the fluid can be removed from the well **4** by the vacuum exceeds the rate at which the fluid is supplied though the inlet means **10**. In this way the level of fluid in the well **4** is maintained at the level of the tip **29** of the needle **25**.

Referring back to FIG. **2**, the chamber assembly **2** is also provided with an outer moat portion **15**A. The outer moat portion **15**A may be used to accumulate the perfusion fluid when a vacuum source is not available. The fluid may be transferred from the inner moat **15** to the outer moat **15**A by the use of suitable wicking material (not shown). The outer moat portion **15**A may be provided with a drain aperture (not shown) to allow it to drain.

Referring next to FIGS. **1** and **5**, the stimulating and detecting means **8**,**9** preferably comprise an electrode **30** engaged

with a mounting means, generally referenced by arrow **200**. The mounting means comprises a micromanipulator mechanism **31**.

The mounting means **200** comprises gripping means **32** adapted to engage the body **1**. The body **1** is shaped so that gripping means **32** provided at the base **33** of the mounting means **200** can engage with an inner surface **34** (best seen in FIG. **2**) of the electrically conductive annular member **19**, and with an outer surface **35** of the base **3**. The gripping means **32** comprises an electrically conductive gripping member **36** which engages with the inner surface **34** of the electrically conductive annular member **19**. The electrically conductive gripping member **36** is connected to a suitable terminal to allow electrical connection to the data recording system.

In a preferred embodiment the electrically conductive annular member **19** is coaxial with the disc shaped base **3**. The electrically conductive gripping member **36** of the gripping means **32** is a flange, and the outer part of the gripping means **32** is a screw **37** which can be tightened onto the outer surface **35** of the base **3**. In a preferred embodiment the screw **37** has a pointed head **38**, and the outer surface **35** of the base is provided with a circumferential groove **39** into which the pointed head seats. In this way, the stimulating and detecting means **8**, **9** can be moved to any radial position on the base **3**, while maintaining the contact to the common earth **19**. The quality of the contact between the conductive gripping member **36** and the earth **19** is increased as the gripping or clamping force is increased.

As shown in FIG. **2**, the net assembly **6** sits snugly inside the cradle formation **5**. An O-ring (not shown) may be provided to create a seal between the outside of the net assembly **6** and the tapering wall **7**A of the cradle formation **5**.

Referring next to FIGS. **6** and **7**, the net assembly **6** comprises a first net means **40** which is nestable inside a second net means **41**.

The first net means **40** comprises a substantially annular frame **42** with a substantially frusto-conical inner surface **43** and a substantially cylindrical outer surface **44**. A flange **45** is provided around the upper circumference of the first net, the flange **45** provided with a plurality of tab formations **46** protruding radially outward. An O-ring seal **47** is engaged with a suitable groove **48** in the outer surface **44** of the first net, and provides a suitable friction force between the first and second nets **40**, **41** when they are engaged. Suitable netting material **49** is provided at the opposite end of the frame from the flange **45**.

The second net means **41** is provided with a substantially annular frame **50** which has substantially cylindrical inner and outer surfaces **51**, **52**, and is also provided with a flange **53** having tab formations **54** which protrude radially outward. In a preferred embodiment the tab formations of both nets **40**, **41** are spaced evenly apart. It is preferred that the first net **40** has a different number of tabs **46** from the number of tabs **54** on the second net **41**, in order to avoid the tabs **46**, **54** from aligning, which would make separation of the nets **40**, **41** more difficult. The second net **41** is also provided with suitable netting material **55** at the opposite end of the frame to the flange **53**. Types of suitable netting material for the first and second nets will be known to those skilled in the art.

In some embodiments a second O-ring (not shown) may be provided around the exterior of the second net means **41**, in order to grip the inner walls of the cradle formation **5**.

Those skilled in the art will appreciate that the frusto-conical shape of the inner surface **43** of the first net **40** reduces or substantially eliminates the "dead" area of the first net **40**, that is, the area which is inaccessable by the stimulating and recording means **8**, **9**.

The nets **40**, **41** are preferably manufactured by an injection moulding process.

Referring next to FIG. **8**, a stimulating means **8** is shown with an alternative electrode mounting means, generally referenced **201**, to that shown in FIG. **5**.

In the embodiment shown in FIG. **8** the electrode mounting means **201** comprises a micromanipulator means **31** and gripping means **32** which are the same as those provided in the embodiment shown in FIG. **5**. However, the electrode mounting means **201** is provided with an electrode engaging means **56** which comprises a sheath **57**. The sheath **57** is preferably formed from a hollow tube, typically made from steel or the like.

A first end of the sheath **57** is provided with a chuck **58**. The chuck **58** is preferably of the collet chuck type, although other chucks may be suitable. The collet is preferably integral with the sheath **57**.

The chuck **58** is adapted to releasably grip the electrode **30** in an "in use" position, as shown in FIG. **8**.

The sheath **57** is shaped and dimensioned to allow the electrode **30** to be retracted inside the sheath **57** when not in use. In this way the electrode **30** can be protected when the apparatus **100** is not in use and/or when the electrode mounting means **201** is being engaged or disengaged from the apparatus **100**.

The distal end of the sheath **57** is preferably also provided with a second chuck **59** which can engage the cable **60** which carries the signal to or from the electrode **30**. The second chuck **60** is preferably also of the collet chuck type. The electrode mounting means **201** may also be used with the detecting means.

Those skilled in the art will appreciate that the present invention provides an apparatus for testing electrical activity from a biological tissue sample which is relatively simple and portable, but which may be more reliable than comparable apparatus of the prior art.

Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise", "comprising", and the like, are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense, that is to say, in the sense of "including, but not limited to".

Where in the foregoing description, reference has been made to specific components or integers of the invention having known equivalents, then such equivalents are herein incorporated as if individually set forth.

Although this invention has been described by way of example and with reference to possible embodiments thereof, it is to be understood that modifications or improvements may be made thereto without departing from the spirit or scope of the appended claims.

The invention claimed is:

1. An apparatus for testing electrical activity from a biological tissue sample, the apparatus comprising a body provided with a well, the apparatus further comprising stimulating means for stimulating a biological tissue sample which is located, in use, in the well, and detecting means for detecting electrical activity in the tissue sample, the apparatus further comprising a fluid inlet means in fluid communication with the well and a fluid outlet means in fluid communication with the well, wherein the inlet means comprises an electrically conductive conduit and the outlet means comprises an outlet passage provided in the body, and wherein the electrically conductive conduit of the fluid inlet means extends through a portion of the outlet passage and is in fluid contact with a fluid flowing, in use, through the outlet passage.

2. The apparatus of claim 1 wherein the body is provided with an electrically conductive member which is electrically connectable to the electrically conductive conduit.

3. The apparatus of claim 1 wherein the electrically conductive conduit has an electrical resistivity of less than 1×10^{-6} Ωm at room temperature.

4. The apparatus of claim 1 wherein the electrically conductive conduit has a thermal conductivity of at least 10 W/m K at room temperature.

5. The apparatus of claim 4 wherein the fluid outlet means comprises a passage adapted to receive a heating element such that the heating element is in thermal contact with fluid flowing though the outlet conduit upstream of the electrically conductive conduit, to thereby transfer heat to the fluid in the inlet means through the electrically conductive conduit.

6. An apparatus for testing electrical activity from a biological tissue sample, the apparatus comprising a body provided with a well, stimulating means for stimulating a biological tissue sample located, in use, in the well, and detecting means for detecting electrical activity in the tissue sample, a fluid inlet means in fluid communication with the well and a fluid outlet means in fluid communication with the well, wherein the fluid inlet means comprises an electrically conductive conduit and the fluid outlet means comprises an outlet passage provided in the body wherein the electrically conductive conduit of the fluid inlet means extends through a portion of the outlet passage and is in fluid contact with a fluid flowing, in use, through the outlet passage, the apparatus further comprising an electrically conductive member in electrical contact with the fluid contained, in use, in at least one of the well, the inlet means and the outlet means, wherein at least one of the stimulating means and detecting means is engaged with the body by a gripping means which comprises an electrically conductive gripping member which engages the electrically conductive member, and the electrically conductive gripping member is electrically connectable to a data recording system which, in use, records the electrical activity from the sample.

7. The apparatus of claim 6 wherein the electrically conductive member comprises an annular ring.

8. The apparatus of claim 7 wherein the annular ring is set into the body.

9. The apparatus of claim 7 wherein the electrically conductive gripping member exerts a force on an inner surface of the annular ring in a radially outward direction.

10. An apparatus for testing electrical activity from a biological tissue sample, the apparatus comprising a body provided with a well, the apparatus further comprising stimulating means for stimulating a biological tissue sample which is located, in use, in the well, and detecting means for detecting electrical activity in the tissue sample, the body provided with a fluid inlet means in fluid communication with the well and outlet means comprising an upwardly open outlet port in fluid communication with the well, and adjustable fluid level regulation means adapted to draw fluid, in use, from the upwardly open outlet port at a required level, the outlet means comprising an outlet passage provided in the body and an outlet aperture which is substantially fixed in position relative to the body, and further wherein the fluid inlet means comprises an electrically conductive conduit which extends through a portion of the outlet passage and is in fluid contact with a fluid flowing, in use, through the outlet passage.

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